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EXAMINER	
KLIMOWICZ, WILLIAM JOSEPH	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/523,281	**Applicant(s)** OHBA ET AL.	
	Examiner William J. Klimowicz	**Art Unit** 2627	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 June 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on June 30, 2010 has been entered.

Claim Status

Claims 1-6 are currently pending.

No Claims currently have been canceled or withdrawn.

Claim Objections

Claims 1 and 4 are objected to because of the following informalities:

(i) With regard to claim 1 (line 15) and claim 4 (line 15), the phrase "aid fixed magnetization layer" should be changed to the phrase --said second fixed magnetization layer-- since the antiferromagnetic layer is coupled to the ***second*** fixed magnetization layer and pins its magnetization.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al. (US 6,710,986) in view of Gill (US 6,052,263), Heim et al. (US 5,465,185) and Jimbo et al. ("Giant magnetoresistance effect and electric conduction in amorphous-CoFeB/Cu/Co sandwiches," - J. Appl. Phys. 79(8), 15 April 1996, pp. 6237-6239), hereinafter Jimbo et. al.

As per claims 1 and 3, Sato et al. (US 6,710,986) discloses a tunnel magnetoresistive device (e.g., see FIG. 2) having: an intermediate layer (310 - tunnel barrier layer made of insulating material); a fixed magnetization layer (e.g., 210 - first magnetic layer - see also, COL. 8, lines 45-56) located directly below and in contact with said intermediate layer (e.g., 310), said fixed magnetization layer (210) is a crystalline ferromagnetic material that is made of an alloy of at least one of the following iron, nickel and cobalt (see, e.g., COL. 3, lines 65 - COL. 4, line 11 - bcc cubic crystal structure, with iron as a component); and a free magnetization layer (110 - e.g., see COL. 8, lines 31-34, and COL. 8, lines 45-46 - wherein the first magnetic layer can have the higher coercivity, and thus the second magnetic layer is the layer with the lower coercivity) located adjacently above said intermediate layer (310), said free magnetization layer is an amorphous ferromagnetic material that is made of an alloy of at least one an iron group element and at least one element selected from the group consisting of element and metalloid elements,

rare earth elements and valve metals (as exemplified, e.g., at COL. 12, lines 18-20 - boron and silicon are metalloid elements), wherein, said fixed magnetization layer (210) and said free magnetization layer (110) are a pair of ferromagnetic layers opposed to each other to obtain variations in magnetoresistance by an electric current flowing in a direction perpendicular to the film plane (see FIG 2, wherein current flows between (110) and (410)).

As per claim 1 (and claim 4, rejected, *infra*), Sato et al. (US 6,710,986) does not expressly disclose wherein an antiferromagnetic layer is coupled to said fixed magnetization layer, said antiferromagnetic layer effective to prevent the magnetization of said fixed magnetization layer from being inverted.

Such antiferromagnetic pinning layers used in the type of analogous sensor as Sato et al. (US 6,710,986) are well known and utilized in the art. As just one example, Gill (US 6,052,263) discloses a tunnel magnetoresistive device (e.g., see FIG. 2) having: an intermediate layer (215 - tunnel barrier layer made of insulating material); a fixed magnetization layer (e.g., 220 - first magnetic layer - see also, COL. 2, lines 41-44) located directly below and in contact with said intermediate layer (e.g., 215), and a free magnetization layer (210 - e.g., see COL. 2, line 48 located adjacently above said intermediate layer (215), wherein, said fixed magnetization layer (220) and said free magnetization layer (210) are a pair of ferromagnetic layers opposed to each other to obtain variations in magnetoresistance by an electric current flowing in a direction perpendicular to the film plane (see FIG 2, wherein current flows between (260) and (265)).

Additionally, as per claim 1 (and claim 4, rejected, *infra*), Gill (US 6,052,263) also discloses wherein an antiferromagnetic layer (230) is coupled to said fixed magnetization layer

(220), said antiferromagnetic layer (230) effective to prevent the magnetization of said fixed magnetization layer (220) from being inverted.

Given the express teachings and motivations, as espoused by Gill (US 6,052,263), it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the antiferromagnetic layer, as is well known in the art, as exemplified by Gill (US 6,052,263), to the fixed magnetization layer of Sato et al. (US 6,710,986) in order to sufficiently pin the magnetization of the fixed magnetization layer Sato et al. (US 6,710,986), via exchange coupling with the antiferromagnetic layer, as is well known, established and appreciated in the art, as demonstrated by Gill (US 6,052,263) at COL. 1, lines 59-62 and COL. 2, lines 45-47..

As per amended claim 1 (and as per amended claim 4, rejected, *infra*), Sato et al. (US 6,710,986) in view of Gill (US 6,052,263) do not expressly disclose wherein the fixed magnetization layer includes a first fixed magnetization layer and a second fixed magnetization layer, and a non-magnetic conductive layer in-between the first and second fixed magnetization layers.

Such structures, however, are well known in the magnetoresistive device art.

As just one example, Heim et al. (US 5,465,185) discloses an analogous magnetoresistive device wherein, in lieu of a single fixed magnetization layer, the fixed magnetization layer includes a first fixed magnetization layer (74) and a second fixed magnetization layer (72), and a non-magnetic conductive layer (73) in-between the first (74) and second (72) fixed magnetization layers.

Heim et al. (US 5,465,185) teaches such a laminated fixed magnetization layer, in lieu of a single fixed magnetization layer, such that "no dipole field to adversely affect the free

ferromagnetic layer," occurs, thus "improv[ing] the sensitivity of the sensor and allow[ing] higher recording density to be achieved in a magnetic recording data storage system." See abstract of Heim et al. (US 5,465,185).

Moreover, as per claim 2 (and claim 5, rejected, *infra*), the laminated first and second fixed magnetizations layers of Heim et al. (US 5,465,185) constitute a laminated ferri structure.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the single fixed magnetization layer of Gill (US 6,052,263) and Sato et al. (US 6,710,986), with a fixed magnetization layer that includes a first fixed magnetization layer and a second fixed magnetization layer, and a non-magnetic conductive layer in-between the first and second fixed magnetization layers, as per claim 1 (and claim 4, rejected *infra*) and constituting a laminated ferri structure as per claim 2 (and claim 5, rejected, *infra*).

The rationale is as follows: one of ordinary skill in the art would have been motivated to provide the single fixed magnetization layer of Gill (US 6,052,263) and Sato et al. (US 6,710,986), with a fixed magnetization layer that includes a first fixed magnetization layer and a second fixed magnetization layer, and a non-magnetic conductive layer in-between the first and second fixed magnetization layers, as per claim 1 (and claim 4, rejected *infra*) and constituting a laminated ferri structure as per claim 2 (and claim 5, rejected, *infra*), such that "no dipole field to adversely affect the free ferromagnetic layer," occurs, thus "improv[ing] the sensitivity of the sensor and allow[ing] higher recording density to be achieved in a magnetic recording data storage system." See abstract of Heim et al. (US 5,465,185).

As per amended claim 1 (as well as amended claim 4, rejected, *infra*), Sato et al. (US 6,710,986), Gill (US 6,052,263) and Heim et al. (US 5,465,185) do not expressly disclose

wherein the amorphous free ferromagnetic magnetization layer has a composition of $(Co_{90}Fe_{10})_{80}B_{20}$.

However, such amorphous free ferromagnetic magnetization layers having a composition of $(Co_{90}Fe_{10})_{80}B_{20}$ used in giant magnetoresistance effect devices are well known in the art.

As just one example, Jimbo et al. discloses an analogous giant magnetoresistance effect device that includes two ferromagnetic layers separated by an intermediate layer (e.g., copper - Cu), wherein the free layer of the sandwich (the layer not coupled to the pinning NiO AFM layer) is an amorphous free ferromagnetic magnetization layer having a composition of $(Co_{90}Fe_{10})_{80}B_{20}$. See II. EXPERINMENT section, p. 6237, and I. INTRODUCTION section, p. 6237. Jimbo et al. discloses using such an amorphous free layer composition since it advantageously "exhibits nearly zero magnetostriction in an amorphous state" (see II. EXPERINMENT section), provides "[l]arge MR ratios," see III. RESULTS AND DICUSSION section and moreover, allows use of a thin film magnetization layer that is "favorable to reduce the demagnetizing field and will be useful to reduce the size of magnetic devices operating at low fields." See col. 2 at page 6239 of Jimbo et. al.

Given the express teachings and motivations, as espoused by Jimbo et. al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the amorphous free ferromagnetic magnetization layer of Sato et al. (US 6,710,986) (in combination with Gill (US 6,052,263) and Heim et al. (US 5,465,185)) as having a composition of $(Co_{90}Fe_{10})_{80}B_{20}$ as expressly and explicitly taught and suggested by Jimbo et. al., since such an amorphous free layer composition advantageously "exhibits nearly zero magnetostriction in an amorphous state" (see II. EXPERINMENT section of Jimbo et. al.), provides "[l]arge MR

ratios," see III. RESULTS AND DICUSSION section of Jimbo et. al. and moreover, allows use of a thin film magnetization layer that is "favorable to reduce the demagnetizing field and will be useful to reduce the size of magnetic devices operating at low fields." See col. 2 at page 6239 of Jimbo et. al.

Claims 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyatke et al. (US 6,842,361 B2) in view of Sato et al. (US 6,710,986), Gill (US 6,052,263), Heim et al. (US 5,465,185) and Jimbo et. al.

See the description of Sato et al. (US 6,710,986), Gill (US 6,052,263), Heim et al. (US 5,465,185) and Jimbo et. al., *supra*.

As per claim 4, Miyatke et al. (US 6,842,361 B2) discloses a magnetic memory apparatus (12) comprising: a magnetoresistive device (38) having a pair of ferromagnetic layers (32, 36) opposed to each other to obtain variations in magnetoresistance by an electric current flowing to the direction perpendicular to the film plane; a word line (50) and a bit line (46) sandwiching said magnetoresistive device (38) in the thickness direction, wherein said magnetic memory apparatus includes said pair of ferromagnetic layers (32, 36) composed of a magnetization fixed layer (36) made of a ferromagnetic layer provided under an intermediate layer (34) and a magnetization free layer (32) being made of a ferromagnetic layer being provided above said intermediate layer (34).

As per claim 4, however, Miyatke et al. (US 6,842,361 B2) does not expressly disclose wherein the magnetization fixed layer (36) made of a crystalline ferromagnetic layer and

wherein the magnetization free layer is made of an amorphous ferromagnetic layer, as particularly set forth and described in claim 4, having a composition of $(Co_{90}Fe_{10})_{80}B_{20}$.

Sato et al. (US 6,710,986), however, discloses an analogous magnetoresistive device having such structure - that is, wherein the magnetization fixed layer is made of a crystalline ferromagnetic layer and wherein the magnetization free layer is made of an amorphous ferromagnetic layer, as particularly set forth and described in claim 4 - see the description of Sato et al. (US 6,710,986), *supra.*

Given the express teachings and motivations, as espoused by Sato et al. (US 6,710,986), it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the magnetization fixed layer of Miyatke et al. (US 6,842,361 B2) as being made of a crystalline ferromagnetic layer and the magnetization free layer is made of an amorphous ferromagnetic layer, as expressly suggested by Sato et al. (US 6,710,986).

The rationale is as follows: one of ordinary skill in the art would have been motivated to provide the magnetization fixed layer of Miyatke et al. (US 6,842,361 B2) as being made of a crystalline ferromagnetic layer and the magnetization free layer is made of an amorphous ferromagnetic layer, as expressly suggested by Sato et al. (US 6,710,986) in order to "provide a magnetic memory which is non-volatile and is capable of reading and writing data at a high speed." See, *inter alia*, COL. 2, lines 27-30 of Sato et al. (US 6,710,986).

Additionally, Miyatke et al. (US 6,842,361 B2)/ Sato et al. (US 6,710,986) do not expressly disclose wherein an antiferromagnetic layer is coupled to said fixed magnetization

layer, said antiferromagnetic layer effective to prevent the magnetization of said fixed magnetization layer from being inverted.

Gill (US 6,052,263) discloses wherein an antiferromagnetic layer (230) is coupled to said fixed magnetization layer (220), said antiferromagnetic layer (230) effective to prevent the magnetization of said fixed magnetization layer (220) from being inverted.

Given the express teachings and motivations, as espoused by Gill (US 6,052,263), it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the antiferromagnetic layer, as is well known in the art, as exemplified by Gill (US 6,052,263), to the fixed magnetization layer of Sato et al. (US 6,710,986) in combination with Miyatke et al. (US 6,842,361 B2), in order to sufficiently pin the magnetization of the fixed magnetization layer Sato et al. (US 6,710,986) (in combination with Miyatke et al. (US 6,842,361 B2)), via exchange coupling with the antiferromagnetic layer, as is well known, established and appreciated in the art, as exemplified by Gill (US 6,052,263) at COL. 1, lines 59-62 and COL. 2, lines 45-47.

Additionally, Miyatke et al. (US 6,842,361 B2)/ Sato et al. (US 6,710,986)/ Gill (US 6,052,263) do not expressly disclose wherein the fixed magnetization layer includes a first fixed magnetization layer and a second fixed magnetization layer, and a non-magnetic conductive layer in-between the first and second fixed magnetization layers.

Such structures, however, are well known in the magnetoresistive device art.

As just one example, Heim et al. (US 5,465,185) discloses an analogous magnetoresistive device wherein, in lieu of a single fixed magnetization layer, the fixed magnetization layer

includes a first fixed magnetization layer (74) and a second fixed magnetization layer (72), and a non-magnetic conductive layer (73) in-between the first (74) and second (72) fixed magnetization layers.

Heim et al. (US 5,465,185) teaches such a laminated fixed magnetization layer, in lieu of a single fixed magnetization layer, such that "no dipole field to adversely affect the free ferromagnetic layer," occurs, thus "improv[ing] the sensitivity of the sensor and allow[ing] higher recording density to be achieved in a magnetic recording data storage system." See abstract of Heim et al. (US 5,465,185).

Moreover, as per claim 5, the laminated first and second fixed magnetizations layers of Heim et al. (US 5,465,185) constitute a laminated ferri structure.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the single fixed magnetization layer of Gill (US 6,052,263) and Sato et al. (US 6,710,986) as applied to Miyatke et al. (US 6,842,361 B2), with a fixed magnetization layer that includes a first fixed magnetization layer and a second fixed magnetization layer, and a non-magnetic conductive layer in-between the first and second fixed magnetization layers, as per claim 4 and constituting a laminated ferri structure as per claim 5.

The rationale is as follows: one of ordinary skill in the art would have been motivated to provide the single fixed magnetization layer of Gill (US 6,052,263) and Sato et al. (US 6,710,986) as applied to Miyatke et al. (US 6,842,361 B2), with a fixed magnetization layer that includes a first fixed magnetization layer and a second fixed magnetization layer, and a non-magnetic conductive layer in-between the first and second fixed magnetization layers, as per claim 4 and constituting a laminated ferri structure as per claim 5, such that "no dipole field to

adversely affect the free ferromagnetic layer," occurs, thus "improv[ing] the sensitivity of the sensor and allow[ing] higher recording density to be achieved in a magnetic recording data storage system." See abstract of Heim et al. (US 5,465,185)

As per the rejection of claim 6, see the discussion of claim 3, *supra*.

Additionally, Miyatke et al. (US 6,842,361 B2)/ Sato et al. (US 6,710,986)/ Gill (US 6,052,263)/ Heim et al. (US 5,465,185) do not expressly disclose wherein the amorphous free layer composition is formed of $(Co_{90}Fe_{10})_{80}B_{20}$

However, such amorphous free ferromagnetic magnetization layers having a composition of $(Co_{90}Fe_{10})_{80}B_{20}$ used in giant magnetoresistance effect devices are well known in the art.

As just one example, Jimbo et al. discloses an analogous giant magnetoresistance effect device that includes two ferromagnetic layers separated by an intermediate layer (e.g., copper - Cu), wherein the free layer of the sandwich (the layer not coupled to the pinning NiO AFM layer) is an amorphous free ferromagnetic magnetization layer having a composition of $(Co_{90}Fe_{10})_{80}B_{20}$. See II. EXPERINMENT section, p. 6237, and I. INTRODUCTION section, p. 6237. Jimbo et al. discloses using such an amorphous free layer composition since it advantageously "exhibits nearly zero magnetostriction in an amorphous state" (see II. EXPERINMENT section), provides "[l]arge MR ratios," see III. RESULTS AND DICUSSION section and moreover, allows use of a thin film magnetization layer that is "favorable to reduce the demagnetizing field and will be useful to reduce the size of magnetic devices operating at low fields." See col. 2 at page 6239 of Jimbo et. al.

Given the express teachings and motivations, as espoused by Jimbo et. al., it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the amorphous free ferromagnetic magnetization layer of Sato et al. (US 6,710,986) (in combination with Gill (US 6,052,263), Heim et al. (US 5,465,185) and Miyatke et al. (US 6,842,361 B2)) as having a composition of $(Co_{90}Fe_{10})_{80}B_{20}$ as expressly and explicitly taught and suggested by Jimbo et. al., since such an amorphous free layer composition advantageously "exhibits nearly zero magnetostriction in an amorphous state" (see II. EXPERINMENT section of Jimbo et. al.), provides "[l]arge MR ratios," see III. RESULTS AND DICUSSION section of Jimbo et. al. and moreover, allows use of a thin film magnetization layer that is "favorable to reduce the demagnetizing field and will be useful to reduce the size of magnetic devices operating at low fields." See col. 2 at page 6239 of Jimbo et. al.

Response to Arguments

Applicant's arguments with respect to claims 1-6 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to William J. Klimowicz whose telephone number is (571) 272-7577. The examiner can normally be reached on Monday-Friday (7:30AM-6:00PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph H. Feild can be reached on (571) 272-4090. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/William J. Klimowicz/
Primary Examiner, Art Unit 2627